MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2022/23

ERA2036 – INTRODUCTION TO ARTIFICIAL INTELLIGENCE

(All sections / Groups)

05 OCTOBER 2023
9:00 a.m. – 11:00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 4 pages including cover page with 4 Questions only.

2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please print all your answers in the Answer Booklet provided.

Question 1

(a) Explain the ten principles of responsible AI.

(i)	Fairness and bias mitigation	[2 marks]
(ii)	Transparency and explainability	[2 marks]
(iii)	Accountability	[2 marks]
(iv)	Data privacy and security	[2 marks]
(v)	Human-centered	[2 marks]
(vi)	Benefit and harm analysis	[2 marks]
(vii)	Collaboration	[2 marks]
(viii)	Awareness	[2 marks]
(ix)	Monitoring and improvement	[2 marks]
(x)	Global perspective	[2 marks]

(b) Describe the concepts of agent and environment in reinforcement learning. [5 marks]

Question 2

(a) Briefly describe the fundamental difference between Breath-First Search (BFS) and Depth-First Search (DFS). [3 marks]

(b) Explain how BFS would solve a maze, including its advantages and potential limitations. [4 marks]

(c) A graph with 8 states is shown in Figure Q2(c).

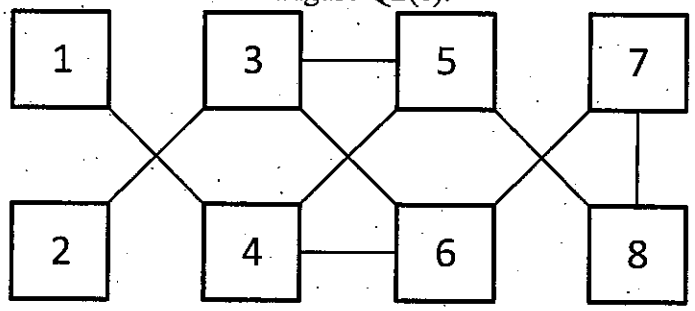

Figure Q2(c)

i. Represent the graph in Figure Q2(c) by using a Python dictionary. [8 marks]

ii. If the initial state is 2 and the goal state is 8, provide the shortest path from the initial state to the goal state for the graph in Figure Q2(c) if each edge has the same cost. [2 marks]

Continued...

Question 2 (cont.)

(d) For the maze shown in Figure Q2(d), the player (☺) can move in four directions only, according to this priority order: Up (U), Down (D), Left (L) and Right (R). The player cannot move into a block that it has previously visited. Using BFS algorithm, generate a tree until the goal state (☆) is reached.

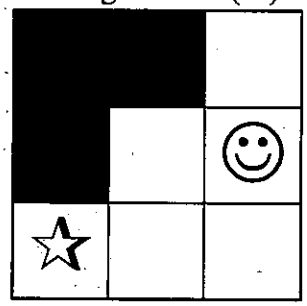

Figure Q2(d) [8 marks]

Question 3

(a) Briefly explain the concept of evolutionary algorithms and their main components. [5 marks]

(b) Define binary encoding and explain its significance in optimization problems. [3 marks]

(c) You are given a school bag that can carry a maximum weight of 12, and a selection of 4 textbooks, with weight $w = [3, 5, 7, 9]$ and values $v = [10, 20, 30, 40]$. Your task is to determine the combination of textbooks that provides the maximum value without exceeding the weight capacity of the bag.

i. Formulate the problem using binary encoding, where 0 represents the exclusion of a textbook and 1 represents the inclusion of a textbook. Explain the meaning of 0 and 1 in this context. [4 marks]

ii. Draw a flowchart to illustrate the main steps of Genetic Algorithm which can be used to find the optimal solution to this problem. [5 marks]

(d) Briefly describe the biological inspiration behind Particle Swarm Optimization (PSO) algorithms and provide an example where PSO can be applied. [4 marks]

(e) Briefly describe the key components in a PSO algorithm. [4 marks]

Continued...

Question 4

(a) Discuss the stages in the workflow of developing a machine learning system.

(i) Problem definition [1.5 marks]
(ii) Data gathering [1.5 marks]
(iii) Data preprocessing [1.5 marks]
(iv) Data splitting [1.5 marks]
(v) Model development [1.5 marks]
(vi) Model evaluation [1.5 marks]
(vii) Model deployment [1.5 marks]
(viii) Model maintenance [1.5 marks]

(b) Below is the confusion matrix of a COVID-19 detection system, in which a positive case infers that the patient is infected.

		Predicted	
		Normal (Negative)	Infected (Positive)
Actual	Normal (Negative)	839	11
	Infected (Positive)	45	105

Analyse the confusion matrix to determine the following performance metrics:

(i) Total number of patients infected by COVID-19 [1 mark]
(ii) True positive [1 mark]
(iii) True negative [1 mark]
(iv) Type I error (false positive) [1 mark]
(v) Type II error (false negative) [1 mark]
(vi) Accuracy [2 marks]
(vii) Precision [2 marks]
(viii) Recall or Sensitivity [2 marks]
(ix) Specificity [2 marks]

Write your steps clearly.

End of Paper